NOvA Experiment Status

Steve Magill Argonne National Laboratory

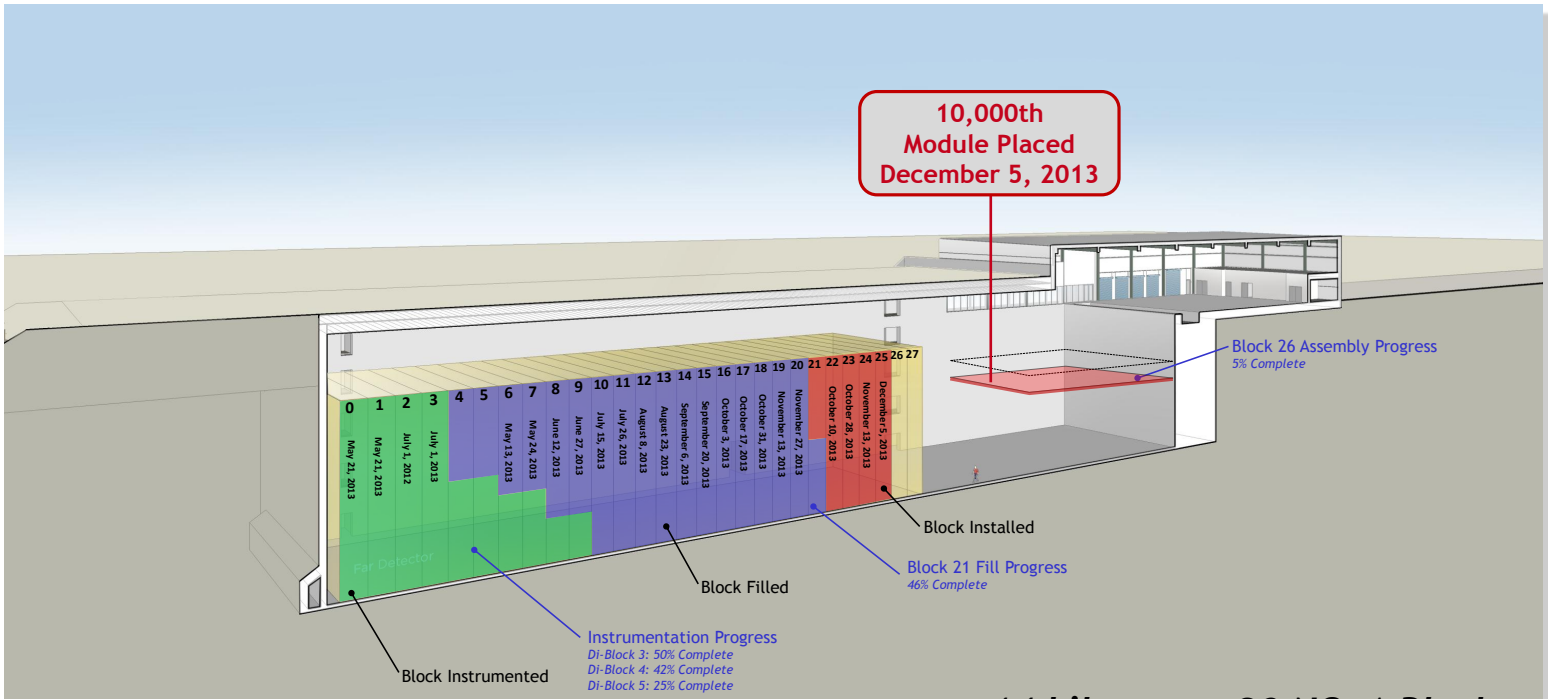
All Experimenter's Meeting, December 9, 2013

Far Detector Construction

The Intensity Frontier

NOvA Far Detector Assembly Progress

Status Date: 09DEC13



14 kilotons = 28 NOvA Blocks

26 blocks of PVC modules are assembled and installed in place

21.46 blocks are filled with liquid scintillator

6.33 blocks are outfitted with electronics

FarDet Outfitting Progress

Di-Block Status (12/09/13)

Di-Block Outfitting Status

Position	DiBlock 14	13	12	11	10	9	8	7	6	5	4	3	2	1
1			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail
2			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail	APD Avail
3			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail	APD Avail
4			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail	APD Avail	APD Avail
5			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail	APD Avail	APD Avail
6			DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail	APD Avail	APD Avail	APD Avail
7	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail
8	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail
9	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail
10	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail
11	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail
12	DCM Avail	DCM Avail	DCM Avail	Filling	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	FEB Avail	APD Avail	APD Avail

Vertical

Horizontal

Block Installation Status

	Block 27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status			APD	Set	Set	Set	Filling	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled	Filled

Filling

Filling block 21 (22nd block) horizontals. Begin filling block 21 verticals. Fix problem FEBs di-blocks 6 downstream. Install FEB power cables top of di-block 101

Friday 12/13: Begin topping up block 21 (22nd block) horizontals.

Block 21

Vertical Modules

Position	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
0	Friday day 12/13/13		Thursday eve 12/12/13		Thursday day 12/12/13		Wednesday eve 12/11/13		Wednesday day 12/11/13		Tuesday eve 12/10/13		Tuesday day 12/10/13		Monday eve 12/09/13	Monday day 12/9/13
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																

Horizontal Modules

Position	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
11	Monday day 12/09/13															
10	239	131	248	151	249	131	247	71	239	125	244	172	245	145	246	147
9	243	245	245	244	245	242	245	243	239	248	244	243	248	242	245	245
8	240	230	241	228	244	235	239	236	237	229	243	231	246	227	244	234
7	240	243	245	243	248	245	242	246	242	243	249	244	245	247	248	241
6	245	242	247	246	245	248	243	245	242	244	247	246	245	248	245	240
5	244	241	247	246	246	248	249	247	247	250	241	246	251	247	239	
4	244	245	244	248	247	248	247	246	246	247	246	249	246	246	245	246
3	244	246	247	244	245	243	243	248	247	243	244	243	244	245	244	245
2	245	243	244	243	243	246	246	248	243	248	246	246	245	244	245	243
1	237	248	245	249	249	250	244	248	250	249	245	247	245	248	252	247
0	247	246	245	243	246	246	245	245	249	246	246	246	247	246	245	248

Monday day 12/16/13

Friday day 12/13/13

Block 20

Vertical Modules

Position	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
0	253	251	238	251	253	252	251	251	251	250	249	249	249	251	252	251
1	250	253	251	251	251	252	254	252	249	252	251	250	250	251	251	251
2	249	252	253	253	252	251	252	250	251	251	251	252	250	251	251	252
3	252	251	253	251	249	252	254	250	250	248	254	248	250	250	252	252
4	253	252	251	251	252	253	252	251	252	252	247	250	250	251	253	252
5	252	250	250	250	251	251	250	250	251	252	252	252	250	249	251	252
6	252	248	254	252	251	252	250	251	250	249	253	249	250	251	250	251
7	247	250	252	254	250	251	251	252	252	251	252	253	250	253	252	250
8	252	250	251	252	252	251	248	249	249	250	251	253	250	251	251	250
9	253	252	251	252	251	251	250	250	249	250	250	251	253	250	251	251
10	249	253	249	250	253	252	251	249	250	252	251	250	251	251	253	251
11	248	250	251	251	252	251	249	250	251	250	251	251	251	250	250	251

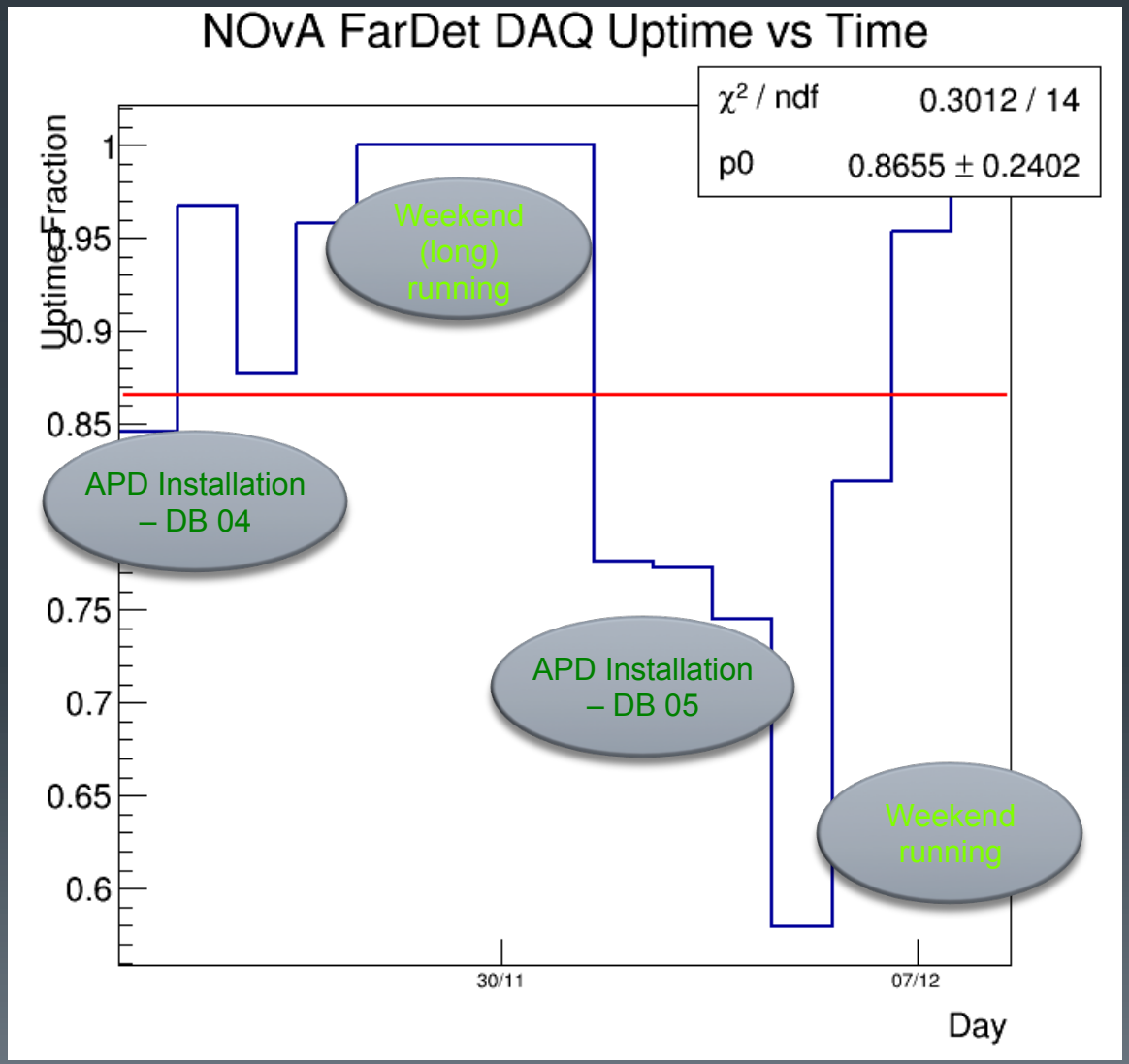
Horizontal Modules

Position	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2	0
11	246	251	250	241	249	233	237	241	239	246	232	239	244	240	245	244
10	245	247	240	244	246	245	246	244	250	247	247	247	245	241	248	239
9	251	248	241	246	243	251	249	248	248	247	247	247	252	246	247	243
8	245	248	247	246	243	246	247	247	247	248	248	246	246	249	249	248
7	242	247	248	248	248	250	246	246	244	246	246	248	247	247	249	247
6	246	245	246	249	247	253	246	242	244	242	247	244	247	249	247	241
5	249	247	243	246	243	247	250	246	244	244	247	247	246	247	249	247
4	246	83	246	248	246	244	245	245	245	246	244	245	246	247	247	101
3	244	244	246	249	246	248	248	243	245	243	245	245	242	247	248	248
2	245	245	249	246	244	248	244	248	244	243	246	243	240	244	251	243
1	250	242	248	246	248	237	245	245	240	231	244	228	238	226	247	243
0	243	243	249	247	243	251	244	247	249	245	248	248	242	243	251	247

Tuesday eve 11/26/13

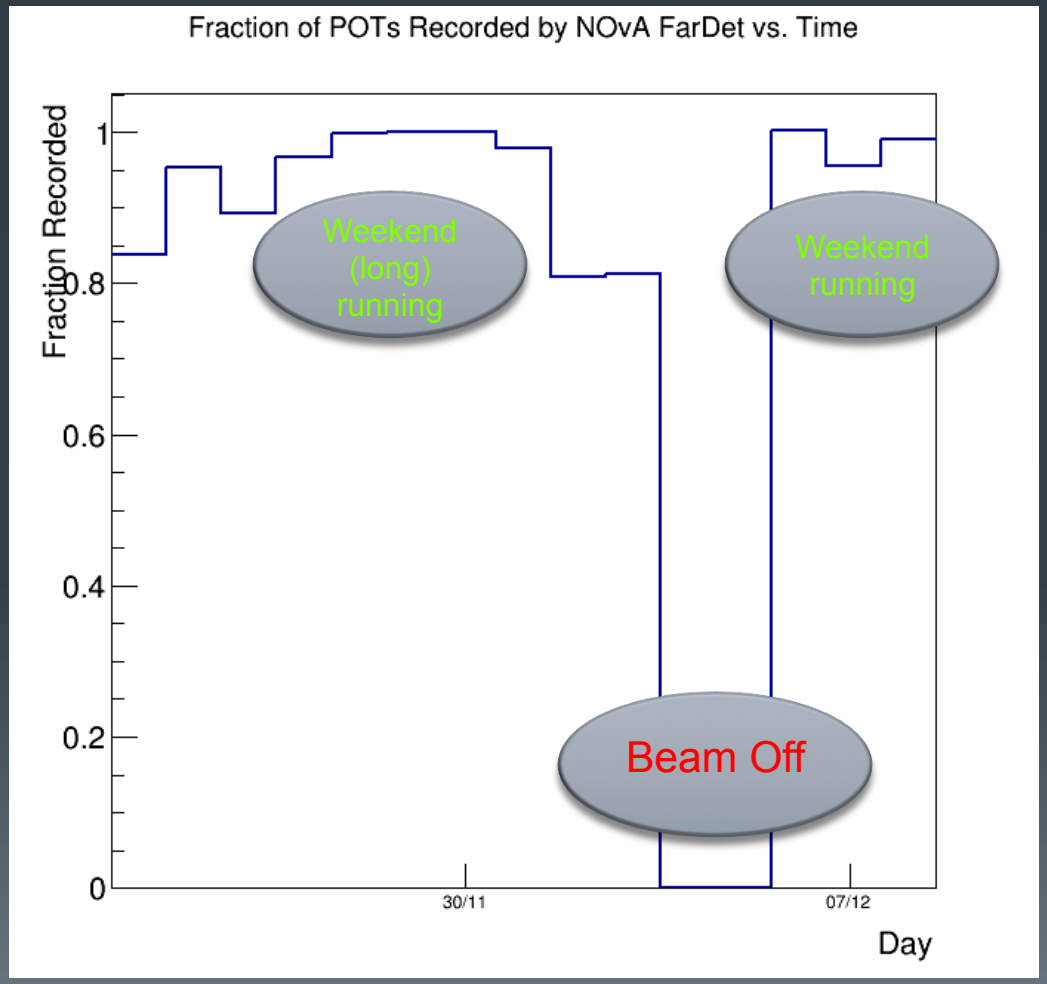
Monday day 12/2/13

FarDet performance – DAQ Uptime



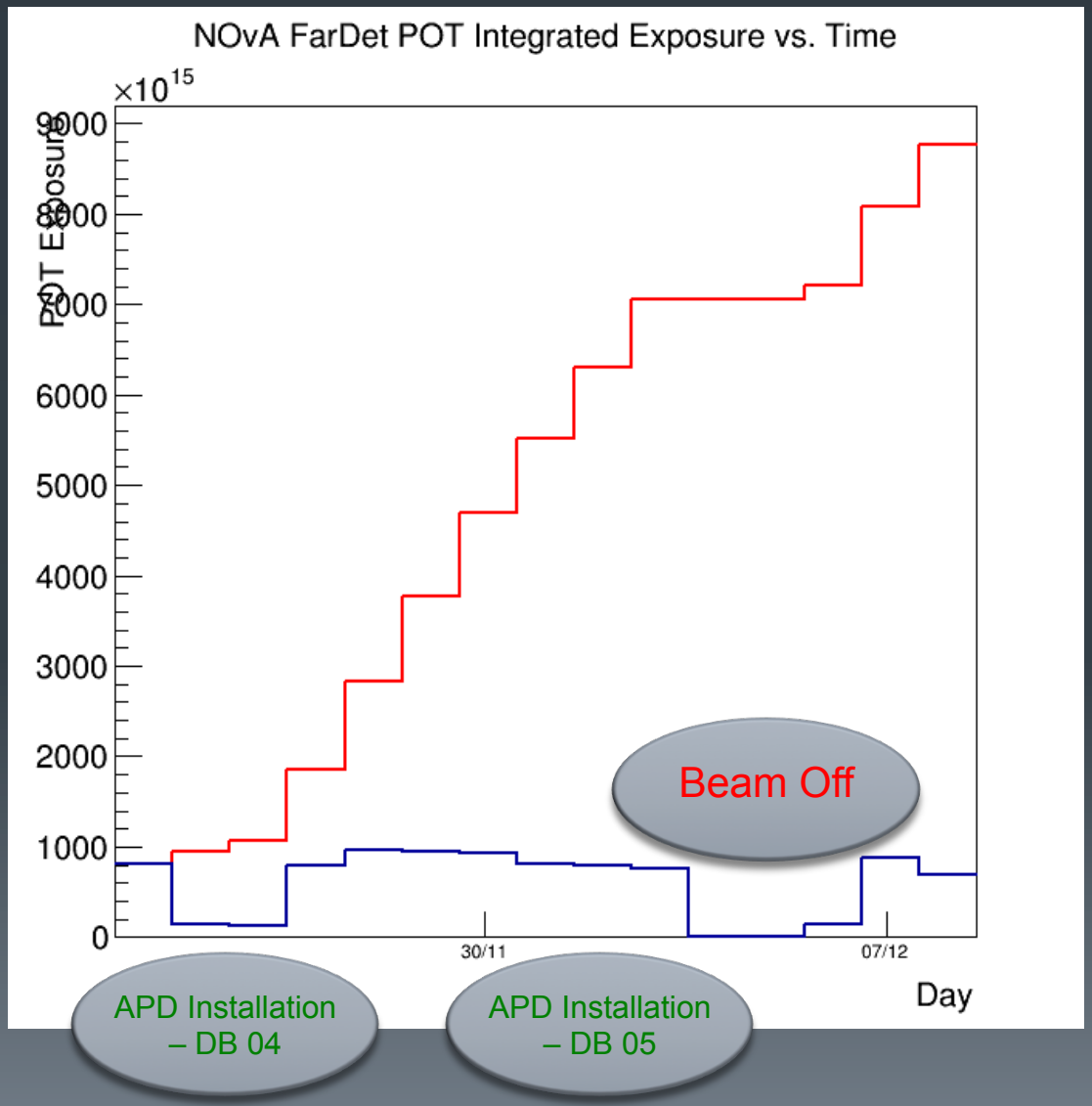
- Very reliable, continuous running on weekends
- APD installation weekdays interrupts DAQ
- Weekday replacements also stops DAQ
- On when beam is off (commissioning with c-rays)

FarDet Performance – Fraction of POTs Recorded



- Very reliable, continuous running on weekends
- DAQ uptime when beam is off (commissioning with c-rays)

FarDet Performance – Integrated POT



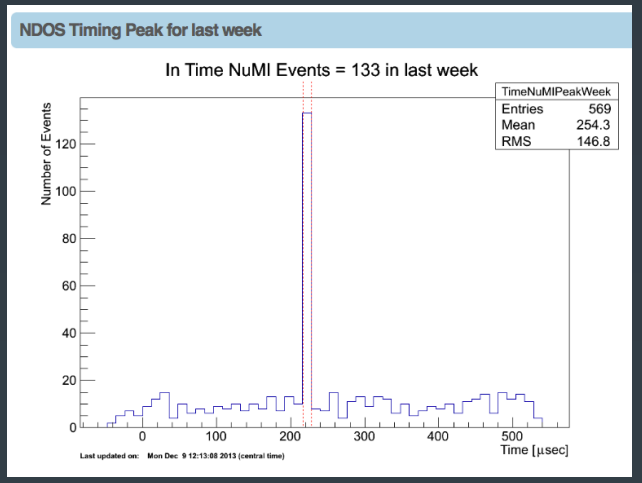
- During APD installation and hardware replacement, DAQ uptime and POT exposure depends on location of work.

FarDet Neutrino Search

- Search for excess of events at expected time of NUMI beam
  - Reminder – plot of events in NDOS (prototype at Fermilab) →
  - Optimizing cuts using MC -> Cut selection for best FOM (s/√b) :

	GENIE (Signal)		Cosmics (Background)	
Cut	**Slices**	**Fraction**	**Slices**	**Fraction**
No Cuts	103	1.0	4.34×10^{7}	1.0
Has a Track	86	0.84	4.0×10^{7}	0.92
Has a 3D Track	78	0.76	3.6×10^{7}	0.84
Min $\cos(\theta_{NuMI})$	40	0.39	1.4×10^{4}	3.24×10^{-4}
Containment	18	0.17	4.0×10^{3}	9.11×10^{-5}
Max Dir_y	12	0.11	342	7.87×10^{-6}

  Expect ~3σ peak after ~3.5 months



- Scan selected events for neutrino interactions
  - Refining filter cuts – optimizing scanning sample
  - Filters applied to entire time window of data (not just expected signal region)
  - Developing strict scanning procedures and scanning tutorials

  Expect time when null observation of a fully contained event falls to below 5% is ~3.6 months at ~4E18 POT/week

Near Detector Schedule

News and Schedule

- Block #8 assembly to start Tuesday IF new modules arrive in the morning
  - *Module delivery delayed due to whether in MN*
  - *Bookend and bridge ladder modifications in MAB*
- PDB/DCM installed for last di-block ➔ Commissioning phase
  - *All cabling to be completed this month*
  - Commissioning discussions are to be in Monday ND meetings
  - *3rd rack ORC walkthrough last Friday: need to replace HVAC CAT5 cable*
  - *Need DCS on power supply ASAP -Ralf/Xuebing-Marianna Gabrielyan/Athans*
- APD dryer and water installations are under way
  - *Erik -Dan Markley-Dennis Nicklaus on readout -- ND group to help out*
- Venting piping P&ID requires separate vent line for each block during filling
- FNAL tanker to be moved to MSB late this week
  - *Temporary generators moved out of the way*
  - *Berm to be installed after MSB windows covered with 1hr fire rated insulations*
  - *Hole on the MSB wall to let tanker hose in – ESH&Q recommendation*
  - *New teflon lined tanker hose with 35' long (50'?)*

Summary

- NDOS Prototype running smoothly, useful for testing of software/firmware/monitoring upgrades before rolling out at FarDet – presently testing new FEBs for Near Detector
- NDSBTest (Near Detector Surface Building Test) 30 APD test stand for cooling/monitoring tests of APDs
- FarDet – 2.5 diblocks running cold at full gain – very smooth running, >3 diblocks instrumented with APDs, 26th block (out of 28) in place – new APD installation ongoing – very good initial performance of APDs w/o A174 primer
- NearDet – 7/8 of the Near Detector blocks are in place – finish in early January 2014, scintillator filling to start immediately after